

OMNIDIRECTIONAL PLANAR OPTICAL CODE READER

BACKGROUND OF THE INVENTION:

This invention relates to a system for traversing a beam of light or other electro-magnetic energy radiation, along or with information contained therein, through a rotating lineal scan pattern, in order that the beam be scanned sequentially and that the scanning be rotated 360° so as to provide beam movement in all possible planar directions. More particularly, the invention is directed to a system for sweeping a shaped light beam through a lineal scan which scan is rotated through a predetermined angle subsequent to each sweep so as to produce an omnidirectional scanning motion on a two dimensional plane. The invention is particularly useful for reading directive graphic codes, containing bits of information, without regard to the physical orientation of the code or an object or target bearing the code.

Many modern business and military activities involve the task of inventorying, cataloging and tabulating massive quantities of goods such as items in warehouses, factories, supply depots and various other commercial retail outlets such as supermarkets. Customarily, these tasks of inventorying, cataloging or tabulating are done manually and, as a consequence, implicitly involve the consumption of excessive amounts of time, the need for a sizeable work force and the opportunity for the introduction of human error.

Various mechanical and electronic code and character reading schemes have been proposed heretofore as substitutes for the wearisome and time-consuming task of manually cataloging and tabulating great quantities of goods; but such proposed alternatives have generally been unacceptable due to a combination of factors such as cost, complexity of construction, difficulty in maintenance, and lack of simple mode of operation. When the items to be inventoried by these prior art systems are given some kind of coding indicia, a critical orientation of each such coded item is necessary for the code to be read.

A video scanning technique using a television camera or the equivalent is among the more widely known possible code and character reading schemes. This technique, however, involves such disadvantages as expense, complexity, the need for highly-trained technicians to perform maintenance, and the relatively short useful life of the camera electrooptical components.

Reading systems including the use of radio waves have also been proposed and considered. These systems, however, involve difficult resolution and noise problems in addition to the requirement for specialized maintenance due to the complexity of the involved radio transmitting and receiving equipment.

Other proposals have been directed to the employment of magnetic techniques. Such proposals, however, have generally involved complex systems which comprise component parts having limited useful lives, for example, reading heads. Additionally, such techniques are susceptible to the accidental erasure of recorded information.

Various systems employing light energy have been proposed. Exemplary, is a system including an optical scanner situated to view a counter surface upon which

surface coded articles may be placed for reading. These systems have generally been unacceptable due to problems involving difficulty in focusing due to varying target distances which difficulties have resulted in reduced speed of operation and the need for an automatically adjustable lens system. Expense and complexity of construction leading to increased maintenance cost have also provided disadvantages. The greatest disadvantage, however, has been the requirement that the coded object to be read be oriented in a particular predetermined position relative to the scanning light beam of the reading apparatus, for example, the code or characters or bits of information contained therein to be read being necessarily situated orthogonal to the direction of scan, due to the inherent sensitivity to orientation of the system.

In order to solve the problem of orientation, effort, has been directed towards the development of coding techniques. These efforts, while leading to advances in the art of coding, have generally been unsuccessful in providing an acceptable solution. Of the many coding techniques developed as a result of the aforementioned efforts, the most familiar technique involves color coding the indicia to be read.

The present invention, when used as a reading device, enables a coded word having directional characteristics, such as a directive graphic code consisting of a series of juxtaposed bars, corresponding to bits of information, to be read regardless of the physical orientation or position of the coded object when it is situated within the bounds of an observation plane or a scanned target area. As such, the subject invention, when employed as a code reading device, presents the advantage of not requiring the critical orientation of a coded item for a code and each bit of information placed thereon to be read.

SUMMARY OF THE INVENTION

Briefly described, the present invention involves a system including apparatus for sweeping a pattern comprising a beam of electromagnetic energy radiation, such as light, either containing information or having an elongate transverse cross-section, respectively, across a reader aperture or a target area containing the information or code in a manner such that the scan or sweep of the pattern of said beam of light is rotated through a pre-determined angular increment after each succeeding sweep, the result being that the reader aperture or coded target area is successively scanned in a plurality of different directions or omnidirectionally.

More particularly, the desired result is accomplished, in accordance with one embodiment of the invention, by directing a shaped beam of light shaped by a mask at a rotating mirror drum which causes the shaped beam of light to be scanned across a reflecting prism such as a Dove prism or its equivalent e.g., a K-mirror which reflecting prism has the quality of totally internally reflecting incident light rays an odd number of times and which is adapted to be rotated about its longitudinal axis. Light rays emerging from the reflecting prism, when projected at a target area, will be successively or sequentially scanned across the target area in a plurality of directions, each successive direction being displaced by rotation through a predetermined angle about and in a plane normal to an axis extending